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The Impact of Plumage Colour of Quails on Embryonic Mortality and Hatchability of Fertile Eggs

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Abstract

The impacts of plumage colours of quails (*Coturnix coturnix japonica*) on some hatching performance parameters for quails were reviewed in this study. Fertility (F), early stage deaths (ES) with last stage deaths + pipped but un-hatched (LS+PU) embryonic mortality and hatchability of fertile eggs (HFE) as hatching performance parameters were studied. A total of 144 hatching eggs which were obtained from middle-aged (15 week) quail breeders with harlequin brown (original) and white plumages were used. Average values of quails having original and white plumage colours respectively were 73.11 % and 72.90 % for F, 4.44 % and 4.88 % for ES, 11.92 % and 6.29 % for LS + PU, 78.86 % and 80.20 % for HFE. As a result, it was seen that the hatching eggs obtained from quails having white plumage colour were numerically lower in F, higher in ES and higher HFE rates because of lower LPU in comparison to quails with harlequin brown plumage. The differences between the treatments were not found to be significant ($P > 0.05$), so it can be told that the plumage colour doesn't affect hatching performance. However, it is thought that continuation of studies including the rearing period will be beneficial for both academicians and quail producers.
Keywords: Quail, plumage colour, hatching egg, incubation performance.

Özet

Bu araştırmada tüy renginin bıldırcınlarda (*Coturnix coturnix japonica*) kuluçka performansına etkisi incelenmiştir. Döllülük oranı (D), erken dönem (ED) ve son dönem + kabuğunu kırmış çıkamamış (SDEM + KKÇ) embriyo ölümleri ile çıkış gücü (ÇG) bu araştırmada incelenen kuluçka performansıyla ilgili özellikler olmuştur. Araştırmada orta yaşlı (15 hafta) orijinal (kırçıllı kahverengi) ve beyaz tüylü damızlık bıldırcınlardan elde edilen toplam 144 kuluçkalık yumurta kullanılmıştır. Orjinal ve beyaz tüylü bıldırcın yumurtaları için sırasıyla % 73.11 ve 72.90 D, % 4.44 ve % 4.88 ED, % 11.92 ve % 6.29 SDEM + KKÇ, % 78.86 ve % 80.20 ÇG değerleri elde edilmiştir. Sonuç olarak orjinal renkte tüylere sahip bıldırcınlara göre beyaz tüylülerden elde edilen kuluçkalık yumurtalarda rakamsal olarak D oranının biraz düşük, ED oranlarının biraz yüksek, buna karşılık LPU oranlarının biraz düşük ve buna bağlı olarak ÇG oranlarının da biraz daha yüksek olduğu görülmüştür. Ancak muameleler arsındaki fark istatistik olarak önemli bulunmamış ($P > 0.05$) ve bıldırcınlarda tüy renginin denemede incelenen bu kuluçka parametrelerini önemli ölçüde etkilemediği tespit edilmiştir. Bununla birlikte konu ile ilgili yetiştirme dönemini de içine alacak çalışmalar düzenlenmesinin hem akademik hem de yetiştiricilik camiası açısından faydalı olacağı düşünülmektedir.
Anahtar Kelimeler: Bıldırcın, tüy rengi, kuluçkalık yumurta, kuluçka performansı.

1.Introduction

Alternative poultry production has been increasing rapidly in the world in the last few decades. One of these alternative poultry breeding sources is quails, which show higher production rate than other poultry breeds. An important advantage of quail breeding is their being pure breeds; in other words, it is obligatory to buy new hybrid chicks at the beginning of each production period for meat and egg production.

It is known that the proximity of both parent and offspring affects the incubation results. Sittman et al. (1990) found that the hatchability

of fertile eggs of chicks with 50% blood proximity was much lower than that of the control group. Therefore, quails older than 6 months should not be used as breeder. Therefore, the herd should be renewed at least once every 6 months.

Optimum conditions before and after incubation must be achieved for successful hatching. Japanese quails have a gradual increase in fertility and hatchability up to 12 - 14 weeks of age. However, this also has an effect on increasing egg size with advancing age, and the highest yields have been reported with eggs above 9.5 g (Sarıca and Soley, 1995). The gradual decrease in fertility and hatchability during the age of 15 - 19 weeks increases rapidly after the 19th week (Insko et al., 1971). It was noted that the fertility rate in quails increased from 8 weeks to 17 weeks, then gradually decreased, whereas hatchability decreased gradually from 8 weeks to 22 weeks (Narahari et al., 1988). Dixon et al. (1992) 11-13 weeks of quail fertility 87 %, hatchability 40 – 66 % and Kumar et al. (1990) found the fertility between 71-81.4% and the hatchability between 51.1 % - 67.7 % in 20 - 24 week-old quails. Erensayın (2002), 20 and 10 weeks of age in Japanese quail fertility of 63.47 % and 77.53 %, respectively; early stage embryonic mortality 14.57 % and 8.99 %, late stage embryonic mortality 14.09 % and 12.14 %, total embryonic mortality 20.56 % and 15.28 %, hatchability 69.44 % and 74.72 % reported hatchability as 56.81 % and 70.34 %. Accordingly, fertility rate in quails, 66.5 % – 90 % (Khurshid et al., 2004; Petek and Dikmen, 2004; Aktan and Camci, 2005; Seker et al. 2006; Lacin et al., 2008), hatchability of 67.6 % - 80.7 % (Khurshid et al., 2004; Romao et al., 2009), embryonic mortality rates 11.6 % - 17.8 % (Khurshid et al., 2004; Garip and Dere, 2006).

Meanwhile, plumage colour is considered as a breed or line trait in quails. In the researches, the quail lines are named according to the plumage colour mutations. For the last decades, new lines with different plumage color mutations are being tried to be obtained (Cneg and Kimura, 1990).

There are not many studies on the effects of plumage color on incubation performance and hatching parameters in quails. Accordingly, the aim of this study was to determine how the hatching results were affected by plumage color of Japanese quails (*Coturnix coturnix japonica*) in the light of the above information.

2.Material and Methods

In this study, a total of 266 (130 original and 133 white plumage) hatching eggs used in the experiment were collected from two 14 – week - old quail breeder flocks having original (harlequin brown) and white plumage. Down - grade eggs were determined and removed from the experiment. Finally, selected 144 (77 original and 77 white plumage) hatching eggs to be set were numbered. The incubation process was carried out in the incubation laboratory of Bolu Abant Izzet Baysal University (B.A.I.B.U) Faculty of Agriculture and Natural Sciences, Department of Poultry Science and Technology using a special incubator with a capacity of 144 quail eggs (Cimuka CT60SH, Cimuka Ltd. Co., Turkey). The same machine was used for whole incubation process. The incubator was equipped with two trays with a capacity of 72 eggs each, and as well two hatch baskets with same egg capacity for the last 3 days of incubation. A layout plan for eggs was prepared to ensure that those with similar weights would be included in the same tray. Once the eggs were placed in the tray according to the layout plan, the incubation process was carried out. The eggs were stored for fifteen days before incubation and the storage room temperature was kept at 18 °C and the humidity at around 75 %. After the storage period, setter trolleys with pre - set egg trays were randomly placed in the incubators. Before the incubation period, the incubators were kept at 24 °C for six hours to preheat the eggs. During the incubation period, all incubators were operated to achieve an eggshell temperature (EST) of 37.78 °C (100.0 °F). The relative humidity in the incubator was maintained as 57 % until transfer, and then increased from 57 % to 58 % during the transfer, 60 % during pipping and 70 % during hatching. the moisture of the incubation room was adjusted to 50 % using two cold and warm humidifiers equipped with an ionizer humidificator (Weewell WHC752, Foshan Samyo Electronic Co. ltd., China) to ensure that the machine humidity was kept at 57 % stable during incubation. The eggs were turned 24 times a day. On the 18th day of incubation, the eggs were transferred from the trays to the hatch baskets of the same incubators while maintaining the layout.

After the incubation were completed, fertlity (F), early stage (0 - 5th days as EEM), and late stage (18 - 21th day) + pipped but unhatched (LEM + PU), and the HFE values were

calculated from the data obtained. Middle stage (6 - 17th days as M ± SEM) values were calculated by using following formulas (Formula 1, 2, 3 and 4).

Formula 1. Calculating formula of fertility (%).

$$\text{F (Fertility), \%} = \frac{\text{Number of Fertile Eggs,}}{\text{Number of Total Incubated Eggs}} \times 100$$

Formula 2. Calculating formula of early stage embryonic deaths (%).

$$\text{EEM (Early Stage Embryonic Mortality),\%EEM (Early Stage Embryonic Mortality),\%} = \frac{\text{Number of Early Stage Dead Embyros,}}{\text{Number of Total Incubated Eggs}} \times 100$$

Formula 3. Calculating formula of last stage and piped but unhatched embryonic deaths (%).

$$\text{LEM+PU (Last Stage Embryonic Mortality), \%} = \frac{\text{Number of Last Stage Dead+Pipped but Unhatched Embyros,}}{\text{Number of Total Incubated Eggs}} \times 100$$

Formula 4. Calculating formula of hatchability of fertile eggs (%).

$$\text{HFE (Hatchability of Fertile Eggs), \%} = \frac{\text{Number of Hatched Chicks,}}{\text{Number of Incubated Fertile Eggs}} \times 100$$

A statistical package program (Minitab 16.2) and two-sample t test formula were used to analyse differences between egg quality parameters as given by Kocabas et al. (2013) in Formula 5.

Formula 5. The formulas used in the calculation of t statistic value in the experiment.

$$t = \frac{(\mu_{\bar{x}} + \mu_{\bar{y}}) - \mu_D}{s_D}$$

$\mu_{\bar{x}}$ = means of original plumage colour $\mu_{\bar{y}}$ = means of white plumage colour μ_D = means of differences between groups s_D = standard deviation

$$s_D = \sqrt{s_{\bar{x}}^2 + s_{\bar{y}}^2}$$

$s_{\bar{x}}^2$ = variance of orignail plumage colour $s_{\bar{y}}^2$ = variance of white plumage colour

P-values of less than 0.05 were considered as statistically significant. All the data were given as means ± standard error of the means (M ± SEM).

4.Results and Discussion

At the end of the incubation period, the analysis results of the parameters examined in quail having two plumage colours were summarized in Table 1 and their evaluations were made separately.

Table 1. The obtained incubation parameters from the experiment.
Çizelge 1. Denemeden elde edilmiş kuluçka parametreleri.

	Plumage Colour		P Value
	Harlequin	White	
Fertility, %	73.11 ± 7.14	72.90 ± 11.10	0.988
Early Stage, %,	4.44 ± 2.00	4.88 ± 2.88	0.903
Late Stage + Pipped but Unhatched, %,	11.92 ± 2.99	6.29 ± 3.39	0.241
Hatchability of Fertile Eggs, %	78.86 ± 3.58	80.20 ± 3.18	0.785

When the F values of hatching eggs obtained from quails having different plumage color were examined, it was seen that the F of quails having original plumage were slightly higher as numerically. However, this numerical difference was not found to be statistically significant (P > 0.05).

Similar to F values, EEM values were slightly lower in quails having original plumage colour and this difference was insignificant (P > 0.05).

In contrast to the F and EEM values, the LEM + PU values were more evidently higher in original plumaged. However, this numerical difference is not statistically significant (P > 0.05). When evaluated according to plumage color, it is thought that the difference between treatments is due to small differences in management conditions but these differences are not large enough to reach a significant level.

Due to the numerically higher LEM + PU values, the HFE values are also slightly lower in quails having original plumage. However, the difference between the HFE values of the groups was also not significant (P > 0.05). It is thought that the numerical differences may have been caused by management conditions.

5.Conclusions

As a result, it was seen that the hatching eggs obtained from quails having white plumage were slightly lower in F, slightly higher in EEM, numerically lower in LEM + PU, and consequently higher HFE values in comparison to original (harlequin brown) plumage colour. However, the differences between the treatments were not found to be statistically significant and it was found that plumage color of quails did not significantly affect the hatching parameters examined in the experiment. In addition, it is thought that continuation of studies including the related breeding period will be beneficial for both academic and breeding area.

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